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# UM1676

## User manual

### Getting started with .NET Micro Framework on the STM32F429 Discovery kit

## Introduction

This document describes how to get started using the .NET Micro Framework (alias NETMF) on the STM32F429 Discovery board (32F429IDISCOVERY). It presents the software and hardware environment required to build a .NET Micro Framework application. A set of C# example projects are provided within the STM32F429I\_Discovery\_NETMF\_Package (STSW-STM32141) allowing fast exploration of this environment.

NETMF is a developer platform for small embedded devices that gives C#, Visual Basic, or Visual Studio programmers access to a subset of the .NET framework programming libraries. It is assumed the reader is already proficient in one of these programming languages.

This document is structured as follows:

- Chapter 1 presents the required software and hardware environment to get started with .NET Micro Framework:
  - Microsoft® Visual Studio®
  - Microsoft .NET Micro Framework Software Development Kit
  - STM32F429I\_Discovery\_NETMF\_Package
  - STM32 ST-LINK Utility
  - STM32F429I\_DISCOVERY NETMF USB driver
- Chapter 2 describes how to build and deploy applications on the hardware.
- Chapter 3 describes how to remove applications.
- Chapter 4 contains links to useful web sites.

## Contents

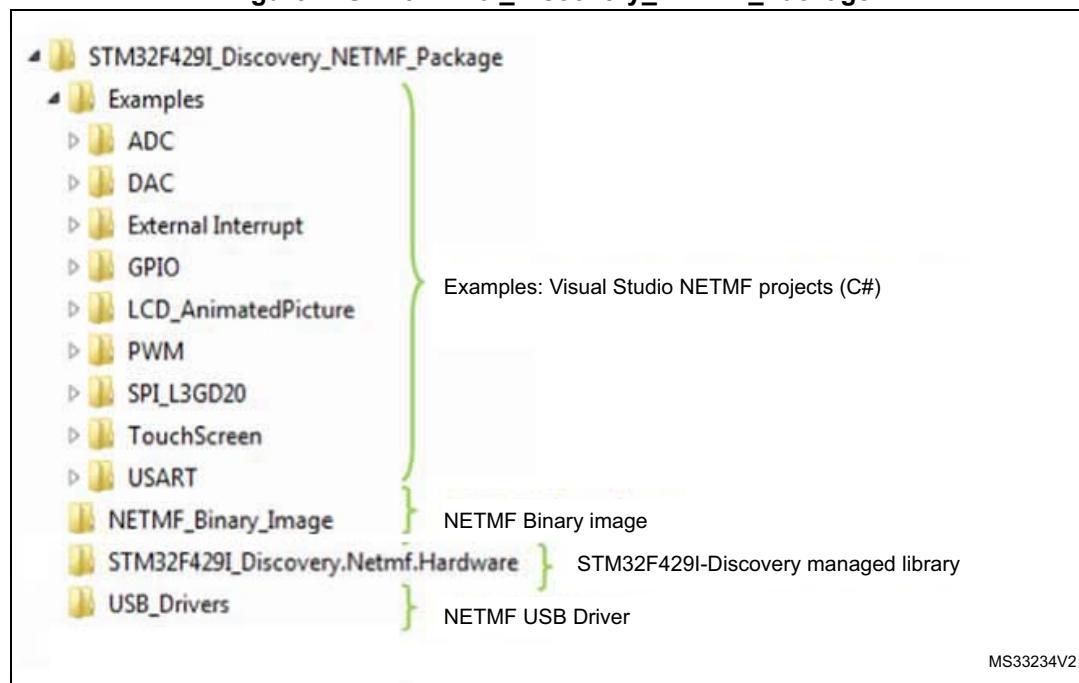
1	<b>Software environment</b> .....	3
2	<b>Create first NETMF application</b> .....	5
3	<b>Erase deployment section using MFDeploy</b> .....	10
4	<b>Useful links</b> .....	11
5	<b>Revision history</b> .....	12

## 1 Software environment

The following software is needed to develop a .NET Micro Framework (NETMF) application. It should be installed if it is not already on your PC.

1. **Microsoft Visual Studio 2012:** You can use the Express edition, a time-limited free evaluation version, downloadable from <http://www.microsoft.com/visualstudio/eng/products/visual-studio-express-products>.
2. **Microsoft .NET Micro Framework SDK version 4.3** downloadable from <http://netmf.codeplex.com/downloads/get/500745>.
3. **STM32F429I\_Discovery\_NETMF\_Package:** Contains binaries, NETMF USB driver, libraries and examples required to develop and run a .NETMF application on the STM32F429 Discovery board. It is available from [www.st.com/stm32f4-discovery](http://www.st.com/stm32f4-discovery) by selecting the product 32F429IDISCOVERY.

**Figure 1. STM32F429I\_Discovery\_NETMF\_Package**

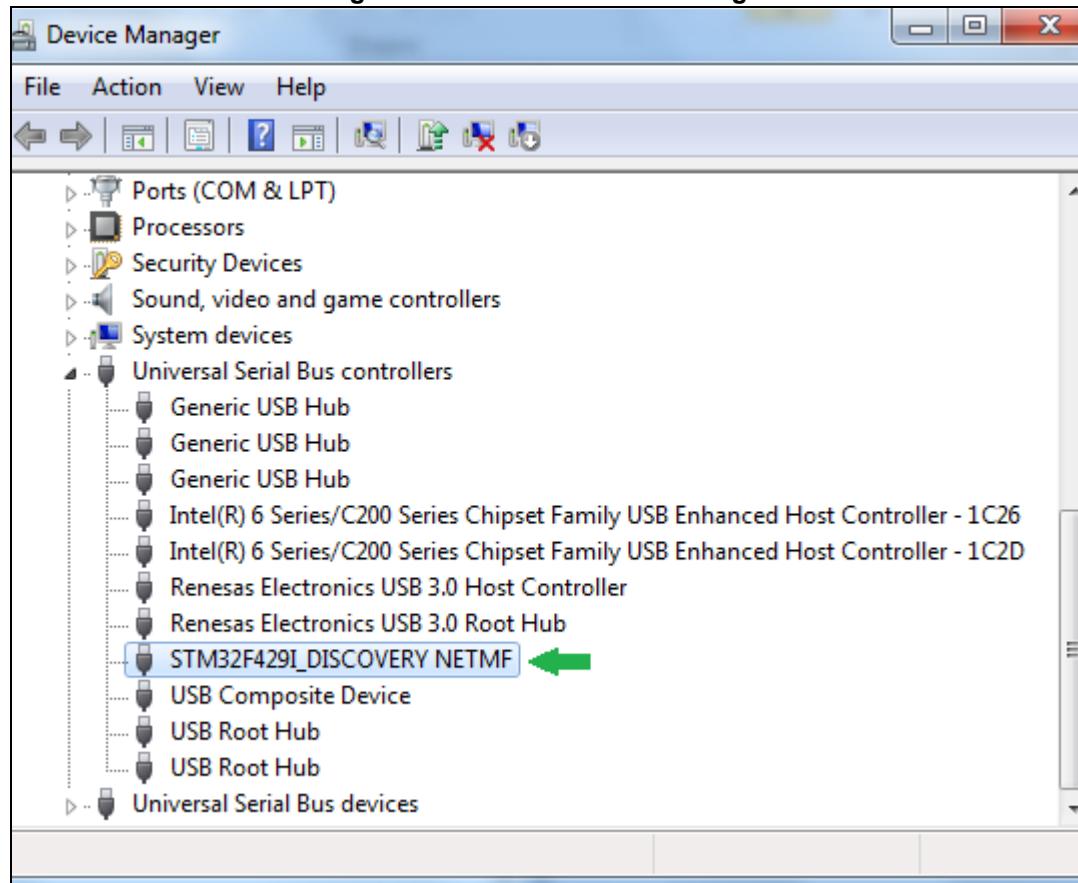


4. **STM32 ST-LINK Utility:** You can use this utility to load the NETMF binary core into the STM32F429 Discovery. It can be downloaded from [www.st.com/stlinkv2](http://www.st.com/stlinkv2). ST-LINK Utility automatically installs the ST-LINK/V2 USB driver. The STM32F429I\_Discovery\_NETMF\_Package\NETMF\_Binary\_Image contains the NETMF binary image which consists of three hex files that should be loaded using ST-LINK Utility into the STM32F429 Discovery board.

5. **STM32F429I\_DISCOVERY NETMF USB driver:** USB USER (CN6) is used to deploy and debug a NETMF application on the STM32F429 Discovery. After loading the NETMF binary into the STM32F429 Discovery, install the NETMF USB driver.
  - a) Connect the STM32F429 Discovery to the computer using USB USER connector. A device called "STM32F429 DISCOVERY" will be detected.
  - b) When windows asks for the driver, browse to the STM32F429I\_Discovery\_NETMF\_Package.
  - c) Once installation is done, an STM32F429I\_DISCOVERY NETMF will be displayed in the device manger as displayed in *Figure 2*.

You are now ready to start your first NETMF application on the STM32F429 Discovery board.

**Figure 2. Windows Device manager**

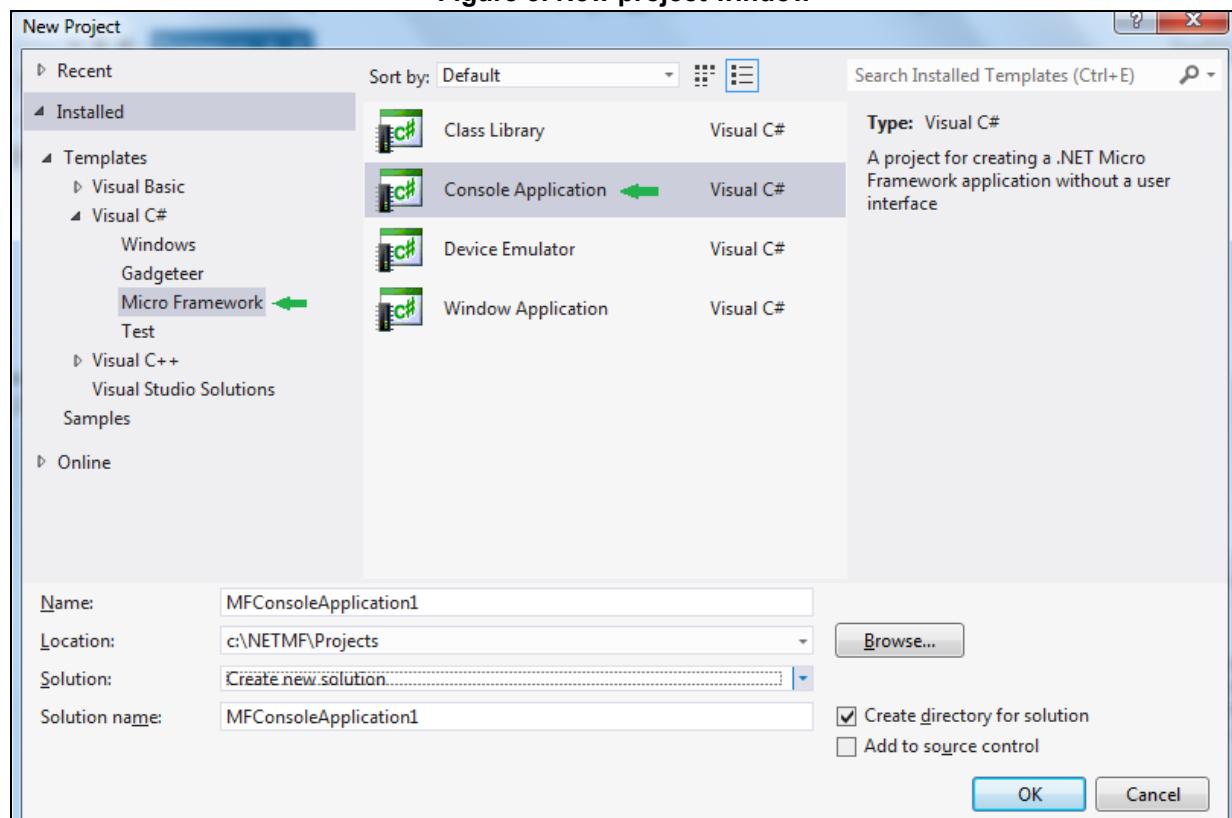


## 2 Create first NETMF application

A good way to get familiarized with the NETMF Development Environment is to create a simple LED toggle program to run on the STM32F429 Discovery board.

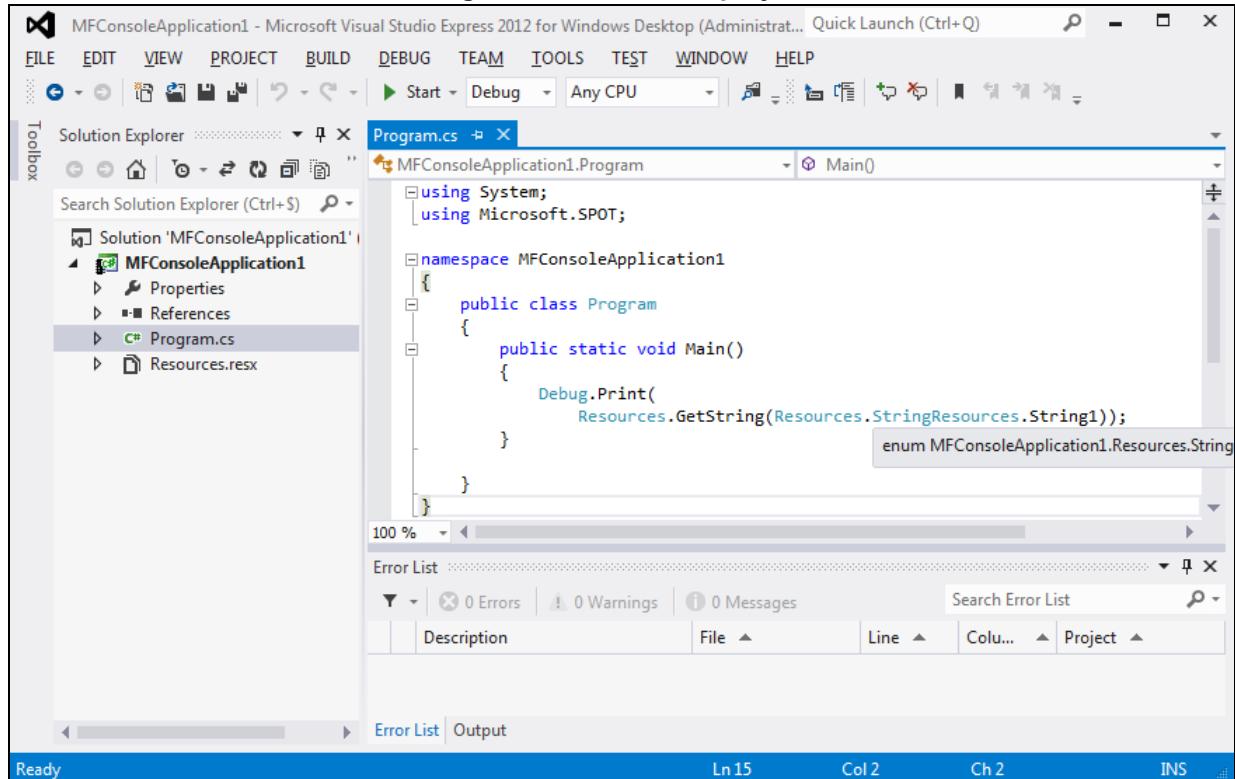
1. Start Microsoft Visual Studio.
2. From the main menu, select *File > New Project...*
3. Click *Visual C# > Micro Framework*, select *Console Application* then click the OK button.

Figure 3. New project window



4. Our first NETMF project is created with only one C# source file named "Program.cs". This program displays a "Hello World!" message in the output window of Visual Studio. Program.cs contains only one class, `Program`, and one method, `Main()`, which is the first method called when the program is run.

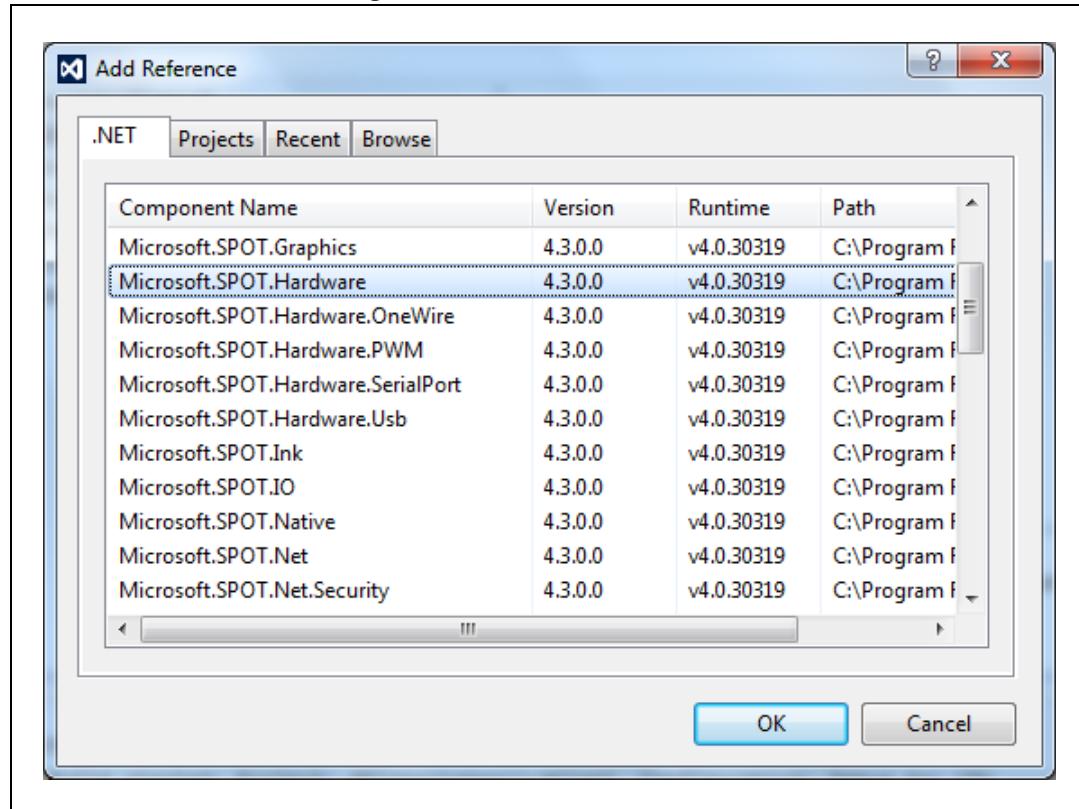
Figure 4. First NETMF project



6. To toggle an LED, the "Microsoft.SPOT.Hardware" component must be added to the project:
  - a) Right click on the *References* in the solution explorer.
  - b) Select *Add Reference*.
  - c) Select *Microsoft.SPOT.Hardware* from the *Add Reference* window.
7. Add "STM32F429I\_Discovery.Netcf.Hardware.cs" library to the project, it contains necessary classes and methods to use features like LEDs:
  - a) Right click on the *MFConsoleApplication1* in the solution explorer.
  - b) Select *Add > Existing Item...*
  - c) Browse to the "STM32F429I\_Discovery.Netcf.Hardware" folder in the STM32F429I\_Discovery\_NETMF\_Package.

*Note:* You can Add As link to avoid copying the source file into the project folder.

Figure 5. Add Reference window



8. Modify the generated Program.cs file (displayed in [Figure 4](#)) as shown in bold below:

```
using System;
using Microsoft.SPOT;
using STM32F429I_Discovery.Netcf.Hardware; // Needed for LED toggling
using System.Threading; // Needed for Sleep() function

namespace MFConsoleApplication1
{
    public class Program
    {
        public static void Main()
        {
            LED.LEDInit(); //LED initialization
            while (true)
            {
                LED.GreenLedToggle(); // Toggle green led
                Thread.Sleep(500); // wait 500 ms
            }
        }
    }
}
```

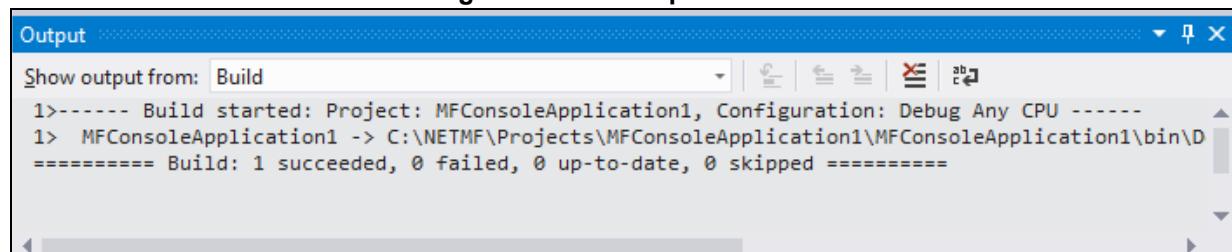
In this code, you added "STM32F429I\_Discovery.Netcf.Hardware" namespace which is declared in the STM32F429I\_Discovery.Netcf.Hardware.cs file to be able to use the LED class.

`LED.Init()` configures the LEDs GPIO port and `LED.GreenLedToggle()` toggles the green LED.

*Note:* Click on the method call and press F12 to go to its implementation.

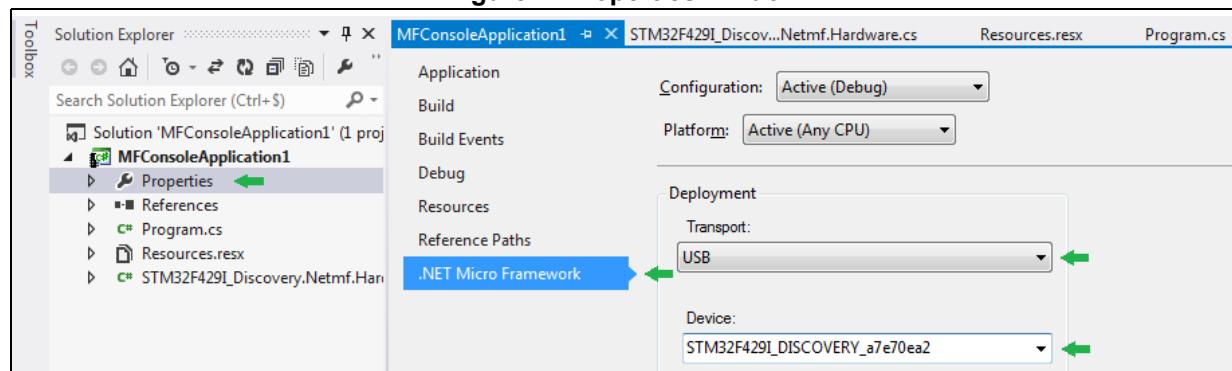
9. Click on *Build > Build Solution* from the main menu (alternatively, click F7).

**Figure 6. Build output window**

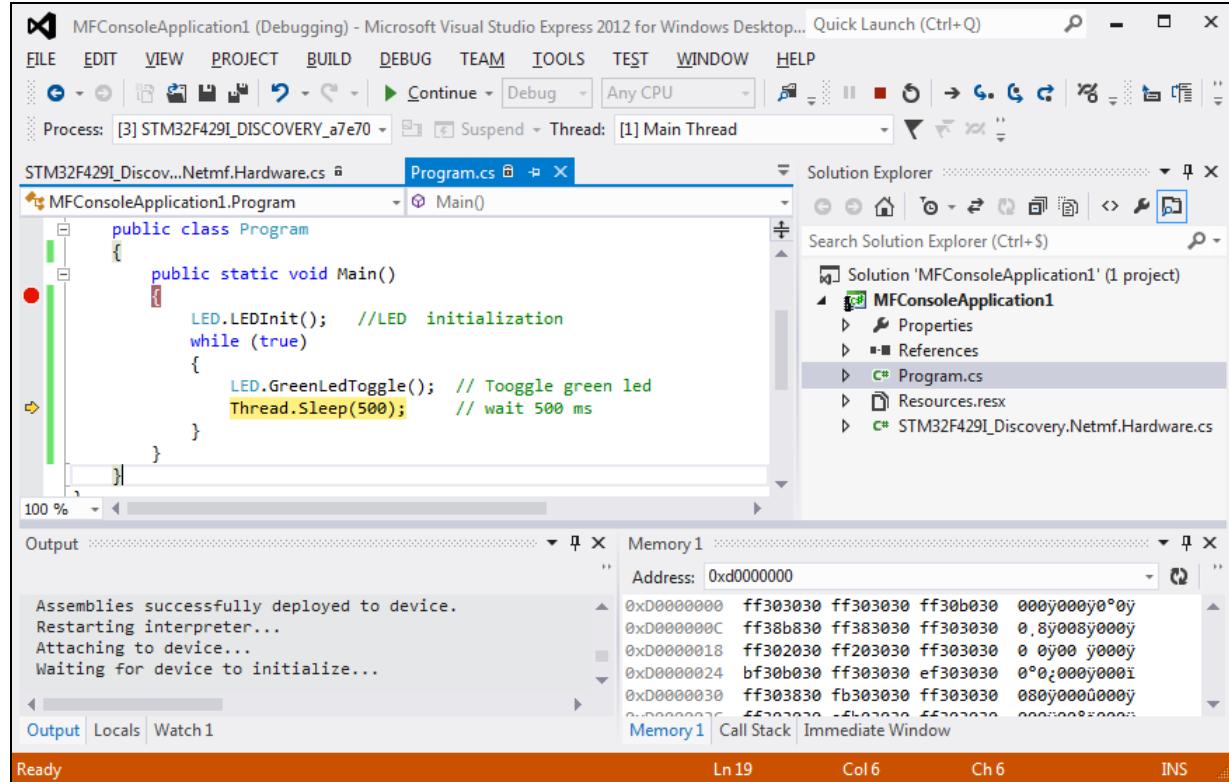


10. Once the project is built successfully, the application must be loaded into the STM32F429 Discovery board. By default, a new project is configured to work with the Emulator. It must be changed to use USB as deployment transport from the Properties in the Solution Explorer (See [Figure 7](#)). The board should be connected to the computer and "STM32F429I\_DISCOVERY\_a7e70ea2" should be displayed in the Device name.

**Figure 7. Properties window**



11. Click on *Debug > Start Debugging* from main menu to load application and enter debug session.

**Figure 8. Debugging in Visual Studio**

The green LED on the STM32F429 Discovery board should now be toggling.

Visual Studio offers many debug features like breakpoints, watch, view memories and step by step execution, that allow easy debug of your application and step by step execution.

To speed up NETMF development on the STM32F429 Discovery board, several C# example programs are available in the `STM32F429I_Discovery_NETMF_Package` under the "Examples" folder. For more information about the examples, a readme file is provided with each example describing its behavior and hardware requirements.

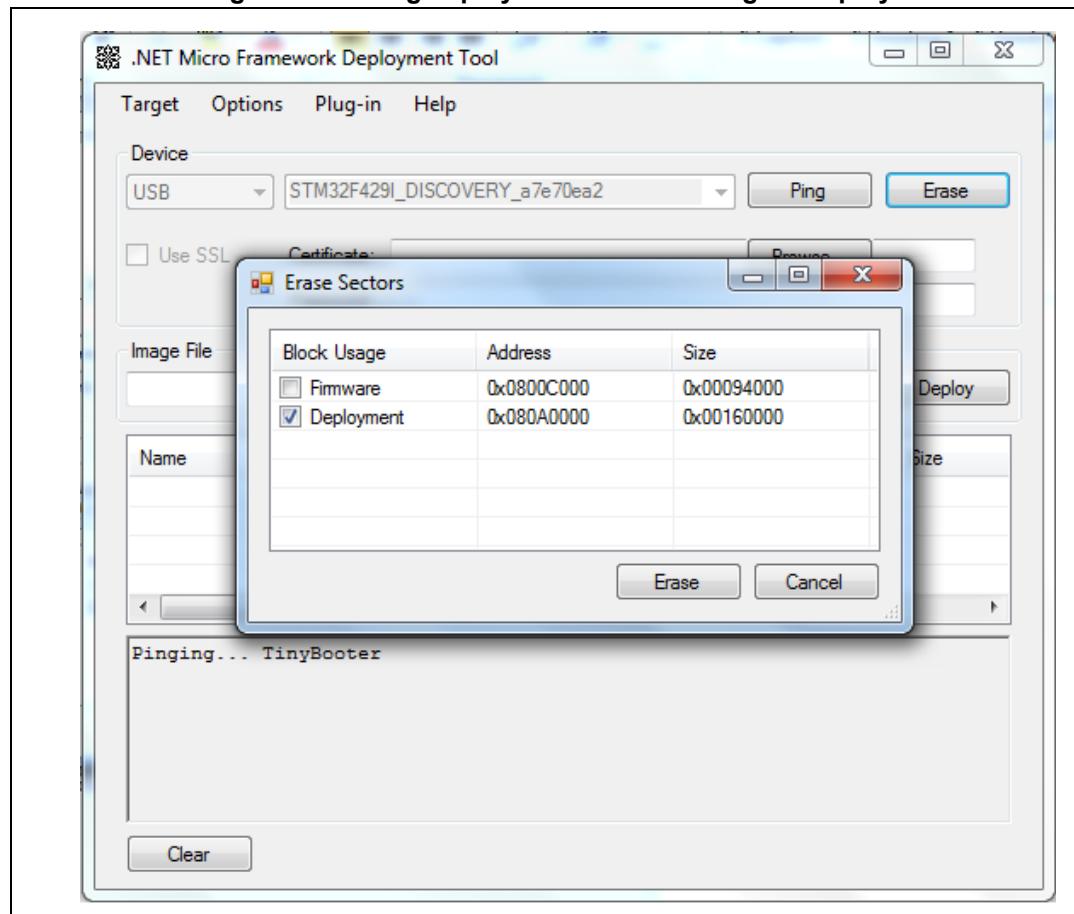
### 3 Erase deployment section using MFDeploy

The NETMF SDK has a useful tool called MFDeploy. it provides many helpful features such as erasing the deployment sectors. A C# application in the deployment section alters the debug communication and Visual Studio cannot override it.

To erase the deployment section:

1. Reset the board while pressing the USER button, to enter TinyBooter mode.
2. Open the MFDeploy from windows *Start menu > Microsoft .NET Micro Framework 4.3.*
3. Select USB as debug channel, "STM32F429I\_DISCOVERY\_a7e70ea2" should be displayed in the Device name. Make sure that there's no ongoing Visual Studio debug session.
4. Click on **Erase** button to open the erase window.
5. Select *Deployment* and click on **Erase** button.

Figure 9. Erasing deployment section using MFDeploy



After erasing the deployment section and resetting the board, you can launch a new debug session using Visual Studio.

## 4 Useful links

The following links provide inspiration and many more examples:

- NETMF community development site: [www.netmf.com](http://www.netmf.com)
- Codeplex STM32 NETMF project: [netmf4stm32.codeplex.com](http://netmf4stm32.codeplex.com)
- STM32 NETMF solutions by Mountaineer: <http://www.mountaineer.org/netmf-for-stm32>

## 5 Revision history

**Table 1. Document revision history**

Date	Revision	Changes
13-Jan-2014	1	Initial release.

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